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DREDGED MATERIAL MANAGEMENT STRATEGY TAMPA BAY, FLORIDA

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TAMPA Estuary Program

Syllabus

The Tampa Bay Estuary Program (TBEP) document "Charting the Course For Tampa Bay" calls for development of a long-term management plan for dredged material and dredged material management in the Tampa Bay area (Action Plan item DR-1). This report is that plan. The intent of the plan is to provide information to ports, agencies, and maritime interests and to foster coordination of dredging and dredged material management to maximize shared placement and beneficial use opportunities while minimizing the environmental impacts and costs associated with these activities.

This report presents the results of three tasks, as follows: 1) develop dredged material volumes and describe dredged material quality, 2) identify existing and potential placement options, and 3) calculate the placement area capacity shortfall. The planning timeframe for the report is 25 years.

The following table summarizes the results of the three tasks:

	Volume Per Year (Cubic yards)	Volume Over 25 Years (Cubic yards)
DREDGING		
Maintenance Dredging		
All Federal channels	900,000	24,400,000
Non-Federal channels, berthing areas, private dredging	300,000	7,400,000
New Work Dredging		
All Federal channels		6,100,000
Non-Federal channels, berthing areas, private dredging		4,100,000
TOTAL	1,200,000	42,000,000
PLACEMENT (figures may not match dredging figures exactly due to rounding)		
Offshore Dredged Material Disposal Site (ODMDS)		11,800,000
CMDA 2-D		5,700,000
CMDA 3-D		14,000,000
Beach		1,800,000
Beneficial Use		4,400,000
Other (Upland, Beneficial Use)		5,800,000
TOTAL		43,500,000
SHORTFALL		
ODMDS		Unknown[1]
CMDA 2-D (without enlargement)		(4,900,000)
CMDA 3-D (without enlargement)		(10,400,000)
Beach		Unknown[1]
Beneficial Use		Unknown[1]
Other		Unknown[1]
TOTAL		(15,300,000)

Note: 1) Unknown values assumed to be equal to zero in determination of total quantities.

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INTRODUCTION

The Tampa Bay Estuary Program (TBEP) document "Charting the Course For Tampa Bay" calls for development of a long-term management plan for dredged material and dredged material management (Action Plan Item DR-1). This report is that plan. Available information from ongoing projects serves as the data for plan generation. No extensive field data was collected for this plan.

The intent of the plan is to provide information to ports, agencies, and maritime interests and to foster coordination of dredging and dredged material management to maximize shared placement and beneficial use opportunities while minimizing the environmental impacts and costs associated with these activities. Coordinated planning among ports and industries in the Tampa Bay area will help ensure that the most environmentally sensitive and cost-effective strategies are pursued, especially in regard to long-range dredged material placement. It will allow bay managers to explore options for beneficial uses of dredged material, minimize impacts to nesting birds on existing placement islands, and promote best available technologies to reduce sediment resuspension during dredging.

This plan reflects conditions at the time it was prepared. The plan is meant to be updated and expanded as needed. The study area addressed in the plan is all of Tampa Bay (further described below). The plan is not intended to be an end in and of itself, but to provide information and foster coordination. In addition, any sites mentioned in the plan as possible depositories for dredged material must be evaluated by the customary planning and permitting processes prior to use. The intention of listing possible fill sites for habitat restoration or otherwise is to raise awareness of the existence of these sites.

Pursuant to the January 1999 Memorandum of Understanding (MOU) between the Tampa Bay Regional Planning Council and the Department of the Army, the U.S. Army Corps of Engineers (Corps) was retained "to perform the 'consultant and professional services'" defined in the agreement, with funds contributed from the U.S. Environmental Protection Agency. Pursuant to the MOU, the Corps agreed to consult with the Tampa Bay Dredged Material Advisory Committee (TBDMAC) identified in the Dredging and Dredged Material Management Action Plan of the Comprehensive Conservation and Management Plan for Tampa Bay. The Corps is to facilitate the meetings of the TBDMAC and respond to comments by individual members of the TBDMAC. Implementation of the MOU also requires coordination with governmental agencies and identification of projects that meet "conceptual" approval by the various agencies, perhaps requiring intergovernmental meetings or workshops. Regardless of the fact that the Corps' work under the MOU may involve analysis of Corps' implementation of Federal projects, the Corps' role in preparing the DMMP is in its capacity as a contractor to the Tampa Bay Regional Planning Council and as a facilitator for the

TBDMAC. Neither the meetings of the TBDMAC nor this report are for the purpose of directing the Corps with regard to its projects.

The Corps prepares Dredged Material Management Plans for Federal navigation projects in the Tampa Bay area, as well as other areas of the country, under the National Harbors Program. A Dredged Material Management Plan Preliminary Assessment for the Tampa Harbor project has been prepared and is dated December 30, 1994. A Preliminary Assessment for St. Petersburg Harbor has been prepared and is dated April 4, 1996. A Preliminary Assessment for the Intracoastal Waterway-Caloosahatchee River to Anclote River is scheduled for completion in September 2000.

This report presents the results of three tasks, as follows: 1) develop dredged material volumes and describe dredged material quality, 2) identify existing and potential placement options, and 3) calculate the placement area capacity shortfall. Each of these tasks is further defined below. The report contains a conceptual plan developed in consultation with the Tampa Bay Dredged Material Advisory Committee. Additional study of dredged material volumes and placement may be necessary for more detailed future work as this report is based on readily accessible data only.

This report considers dredging and dredged material placement projections for the next 25 years, that is, from 2000-2025. The area of interest is Tampa Bay, specifically Tampa Bay as defined for the National Estuary Program. This includes portions of Sarasota, Manatee, Polk, Pasco, Hillsborough, and Pinellas Counties. Figure 1 shows the boundary of the study area.

The average natural water depth in Tampa Bay is 12 feet. The ship channels and berths have depths up to 43 feet and must be dredged periodically to remove shoaled sediments. Regular dredging of ship channels and berths serves area ports and industries. Efficient management of the sizeable volume material dredged throughout Tampa Bay is a challenge.

The TBDMAC is the primary source of data for this plan. While the TBDMAC is open to all, the following members provided data for this plan:

- Tampa Bay Estuary Program (TBEP)
- U.S. Army Corps of Engineers (as contractor to TBEP)
- City of St. Petersburg
- TECO
- Manatee County Government
- Egmont Key Alliance
- TampaBayWatch, Inc.
- Florida Department of Environmental Protection (FDEP)
- Tampa Port Authority
- IMC-Agrico

- City of Tampa
- Board of County Commissioners, Pinellas County
- Hillsborough County

Information was also provided by the following:

- Roy R. Lewis, Lewis Environmental Services, Inc.
- Gahagan & Bryant Associates, Inc.

The format for this report is the following: after the introduction, general information refines the scopes of the three tasks identified above; then, discussion explains how the three tasks were completed; finally, conclusions summarize the main points brought out elsewhere in the text. Following the text are figures, then tables, and lastly, supplements which contain pertinent information.

TASKS

Dredged Material Volumes and Dredged Material Quality

Shoal estimates have been developed for the volume of material expected to require dredging over the next 25 years for construction or maintenance of channels in Tampa Bay. These channels include Federal channels, non-Federal channels, berthing areas, and private channels/marinas. Federal channels are channels constructed or maintained with the assistance of the U.S. Army Corps of Engineers. The Federal government funds the work at these channels in whole or in part. The work is generally classified as either new work or maintenance work. The dredging for these channels is coordinated with, and may be funded in part by, a non-Federal sponsor. Non-Federal sponsors in the Tampa Bay area include West Coast Inland Navigation District; Pinellas County; Manatee Port Authority; Board of County Commissioners, Manatee County; City of St. Petersburg; and Tampa Port Authority. Federal channels are included in the River and Harbor Projects for Intracoastal Waterway (Caloosahatchee River to Anclote River), Johns Pass, Manatee Harbor, Manatee River, Pass-A-Grille Pass, St. Petersburg Harbor, and Tampa Harbor, including Hillsboro River, Alafia River and Upper Channels. These projects are shown on Figures 2 through 11. Non-Federal channels are channels constructed or maintained without Federal funding (Figure 12). Berthing areas are those places, commonly adjacent to channels, where larger vessels are moored, loaded or discharged. Marinas are boat basins with facilities for smaller vessels.

The results of the shoal estimation are reported for each major source of dredged material (Federal channel, non-Federal channel, berthing area or private dredging) and for each major bay segment. The years in which dredging is expected to occur are listed, as are the probable methods of dredging. The

physical and chemical qualities of the materials to be dredged are characterized. Project sponsors are identified.

Existing and Potential Placement Options

Capacities of existing dredged material placement sites were identified. Information is provided about each site, including the facility operator and restrictions on the types of material accepted. Estimates of the storage capacity of new disposal sites and planned expansions to existing facilities are compiled. Relevant information is provided on each site. Potential fill sites, including beneficial use sites, are identified. Quantities of fill required, fill material quality and potential permitting or logistic problems are identified. The acceptability of the potential sites is commented on, with a focus on permitting, logistical and cost issues. Agencies requested to comment on the potential sites are U.S. Army Corps of Engineers, FDEP, TPA Sovereign Lands Division, Florida Game and Freshwater Fish Commission, Southwest Florida Water Management District, and local government environmental management agencies.

Capacity Shortfall

The anticipated shortfall in placement area capacity was estimated for the next 25 years. In assessing the shortfall, the cost of using particular placement sites in relation to the point of the dredged material production is considered.

All data collected for this DMMP and all calculations performed to determine the shortfall are found in Tables 1-12. The numbers in the tables have been rounded for simplicity where possible. The numbers presented in the following text are generally further rounded for ease of reading.

Conceptual Plan

A conceptual plan is presented to meet placement needs for the 25-year planning timeframe. An effort is begun to build consensus on projects meeting conceptual approval from permitting agencies by listing such projects in tables accompanying this plan. The projects on the list should, as a goal, meet U.S. Army Corps of Engineers requirements for dredged material placement.

DISCUSSION

Dredged Material Volumes and Description of Dredged Material Quality

Methodology. Tables 1-8 show dredged material volumes, characteristics, and other pertinent information for maintenance and new work dredging. **Table 1** lists shoal estimates for maintenance dredging for the Federal channels in the study area. Channels are identified by Federal project name. The Tampa Harbor project is further described by reach. The shoaling estimates are given

as per year averages and are then projected until 2025. Three sets of shoaling estimates are provided for comparison purposes. One set is average shoal estimates computed from data in the Jacksonville District dredging history database. The second is shoal estimates from the Corps' 1993 Disposal Area Study (DAS). Note that the DAS does not cover the Intracoastal Waterway, Manatee Harbor, Manatee River, St. Petersburg Harbor, John's Pass, or Pas-A-Grill Pass projects. The shoaling estimates shown under the columns for the dredging history database for the Tampa Harbor Project reaches are based on dredging events since 1990 for comparison with the shoal estimates computed for the DAS. The DAS uses information available at the end of 1992. The two-year overlap is to take into consideration the delay in recording dredging events in official District records since some time may elapse between the date a dredging event physically ends and the date the contracting and reporting procedure is complete. That is to say, the two-year overlap is intended to take into consideration dredging events in the early 1990s for which information may not have been available when the DAS was completed. The third set of shoaling estimates is taken from the Tampa Port Authority's Dredged Material Management Plan dated October 1998. Note that this plan only covers the Tampa Harbor Project. Wherever possible the quantities used in the shoaling analysis computed from the District database are pay quantities, as opposed to bid volumes. Bid volumes are typically estimated based on surveys taken prior to dredging and include a projected shoaling quantity to account for material that settles in an area to be dredged between the time the surveys are collected and the dredging is accomplished. Pay quantities are determined subsequent to dredging and may be more accurate estimates of the quantity of material removed since they are computed after dredging has taken place. Seddon Channel is listed in this table and in Table 5 without a quantity for removal since this channel was deauthorized in the Water Resources Development Act of 1981 from a width of 300 feet to 200 feet and from a depth of 30 feet to 12 feet. The turning basin at the junction of the Hillsborough River, Seddon Channel, and Garrison Channel was deauthorized in the Water Resources Development Act of 1986. The section of Garrison Channel between the bridges has also been deauthorized. This channel is not listed in the tables under the Federal projects.

The total annual shoaling estimate for maintenance material for all of the Federal projects in the study area, based on the District dredging history database, is approximately 938,000 cubic yards. For the Tampa Harbor Project alone it is 828,000 cubic yards. The DAS total annual shoaling estimate (Tampa Harbor Project only) is approximately 873,000 cubic yards. The total annual shoaling estimate computed using data from the Tampa Port Authority's dredged material management plan for the Tampa Harbor Project is 731,000 cubic yards. Thus, the range in yearly amounts of maintenance material removed from the Tampa Harbor Project is 731,000-828,000 cubic yards. A conservative, rounded figure for the total volume of material maintenance dredged from all Federal channels in the study area is 900,000 cubic yards per year. For the Tampa Harbor Project it is 800,000 cubic yards per year.

Until the end of the year 2025, approximately 24,400,000 cubic yards of material are projected to be maintenance dredged from Federal channels in the study area.

Table 2. Table 2 lists shoal estimates for maintenance dredging for non-Federal channels, berthing areas, and private dredging locations (by county) in the study area. The shoaling estimates are given as per year averages and are then projected for the next 25 years. Data for the shoal estimation for non-Federal channels, berthing areas, and private dredging come from several sources, including the Jacksonville District dredging history database (since berthing areas are often dredged under the same contract that adjacent channels are dredged [and funded in whole by non-Federal parties]), the Tampa Port Authority Dredged Material Management Plan, various District reports and dredging plans and specifications, and the members of the TBDMAC.

The total annual shoaling estimate for non-Federal channels, berthing areas, and private dredging locations is approximately 300,000 cubic yards. Up to the end of the year 2025 the total shoaling estimate for non-Federal channels, berthing areas, and private dredging locations is approximately 7,400,000 cubic yards.

Combining all the maintenance dredging, approximately 1,200,000 cubic yards of maintenance material is removed from the study area waterbodies per year. This is 31,800,000 cubic yards over the next 25 years.

Table 3. Table 3 lists known new work Federal dredging projects expected to occur in the Tampa Bay area. New work Federal dredging usually consists of widening or deepening an existing Federal channel or enlarging another project feature such as a turning basin. Proposals for new work Federal dredging come from the non-Federal sponsors of navigation projects on a fairly steady basis. Undoubtedly additional studies will be undertaken for enlargement of Federal projects during the next 25 years. The total amount of dredged material anticipated to be removed from known new work Federal construction projects is about 6,100,000 cubic yards.

The Federal government is in the planning stage or in the preconstruction, engineering, and design stage for the following projects: Tampa Harbor project-Port Sutton Terminal Channel, Ybor Turning Basin, Alafia River; Manatee Harbor Project; Big Bend Channel. The following new work has been authorized but is not scheduled for construction or is in the pre-planning stage: St. Petersburg Harbor (deepening); Tampa Harbor anchorage area (construction). Details on the anchorage area study are not available yet, however, this study would focus on relieving traffic congestion in the existing Tampa Harbor project.

Table 4. Table 4 lists new work dredging projects expected to occur within the planning timeframe in channels that are presently non-Federal, in berthing areas

and in other private locations. The total amount of dredged material anticipated to be removed from new work non-Federal, berthing area, and private construction projects is about 4,100,000 cubic yards.

The total volume of dredged material projected to be removed during new work dredging for all areas of Tampa Bay included in this study is approximately 10,200,000 cubic yards.

Thus, the total volume of dredged material expected for removal in the period 2000-2025 as a result of maintenance dredging or new work dredging is 42,000,000 cubic yards.

Table 5. Table 5 (four pages total) shows the years each waterbody identified in Table 1 is expected to be maintenance dredged over the planning period 2000-2025, along with the amount of material expected to be removed. The average annual shoaling rates used to compute the volumes removed are taken from the sources shown in Table A. The frequencies of removal are taken from the sources shown in Table B.

Table A Average Annual Shoaling Rate Sources	
Segment	**Source**
Egmont 1	Dredging history database
Egmont 2	Assumed to be included in Egmont 1 amount
Mullet Key	Assumed to be included in Egmont 1 amount
Cut A	DAS
Cut B	DAS
Cut C	DAS
Cut D	DAS
Cut E	DAS
Cut F	DAS
Cut G	Dredging history database
Cut J	Dredging history database-assumed to be included in Cut G amount
Cut J2	Dredging history database-assumed to be included in Cut G amount
Cut K	Dredging history database-assumed to be included in Cut G amount
Gadsen Point Cut	Dredging history database
Cut A (Hillsborough Bay)	Dredging history database
Cut C (Hillsborough Bay)	Dredging history database
Port Sutton Channel and Turning Basin	Dredging history database
East Bay	Dredging history database
Cut D (Hillsborough Bay)	Dredging history database
Sparkman Channel	Dredging history database
Ybor Channel	Dredging history database
Seddon Channel	Not expected to be dredged (deauthorized to 12 foot project depth)
Alafia River	Dredging history database
Intracoastal Waterway	Dredging history database
Manatee Harbor	Dredging history database
Manatee River	None available
St. Petersburg Harbor	Dredging history database
John's Pass	Dredging history database
Pas-A-Grill Pass	Dredging history database
Big Bend	1996 Feasibility Report
Port Sutton Terminal Channel	1991 General Design Memorandum
Blind Pass	1992 Inlet Management Plan
Big Bend Berthing Areas	TBDMAC
Intracoastal Waterway Berthing Areas	None available
Manatee Harbor Berthing Areas	Dredging history database
Manatee River Berthing Areas	None available
Port Sutton Terminal Channel Berthing Areas	TBDMAC
St. Petersburg Harbor Berthing Areas	None available
Tampa Harbor Berthing Areas	Tampa Port Authority 1998 DMMP
John's Pass Berthing Areas	None available
Pas-A-Grill Pass Berthing Areas	None available
Hillsborough County	TBDMAC
Manatee County	TBDMAC
Pinellas County	TBDMAC
St. Petersburg County	TBDMAC
Miscellaneous	TBDMAC

Table B Frequency of Removal Sources	
Segment	**Source**
Egmont 1	Jacksonville District 5-year O&M schedule[1]
Egmont 2	Included with Egmont 1
Mullet Key	Included with Egmont 1
Cut A	Jacksonville District 5-year O&M schedule[1]
Cut B	Included with Cut A
Cut C	Included with Cut A
Cut D	Included with Cut A
Cut E	Included with Cut A
Cut F	Included with Cut A
Cut G	Jacksonville District 5-year O&M schedule[1,2]
Cut J	Included with Cut G
Cut J2	Included with Cut G
Cut K	Included with Cut G
Gadsen Point Cut	Based on a 10-year schedule with last event in 1992[3]
Cut A (Hillsborough Bay)	Jacksonville District 5-year O&M schedule[1]
Cut C (Hillsborough Bay)	Included with Cut A (Hillsborough Bay)
Port Sutton Channel and Turning Basin	Based on a 5-year schedule with last event in 1999[2]
East Bay	Based on a 5-year schedule with last event in 1999[2]
Cut D (Hillsborough Bay)	Included with Cut A (Hillsborough Bay)
Sparkman Channel	Assumes maintenance dredging at time of new work construction in Ybor Turning Basin, then 5-year maintenance events
Ybor Channel	Included with Sparkman Channel
Seddon Channel	Project deauthorized to –12'MLW, not expected to be maintenance dredged in planning timeframe
Alafia River	Jacksonville District 5-year O&M schedule[1]
Intracoastal Waterway	Jacksonville District 5-year O&M schedule[1]
Manatee Harbor	Jacksonville District 5-year O&M schedule[1]
Manatee River	Not expected to be dredged
St. Petersburg Harbor	Jacksonville District 5-year O&M schedule[1]
John's Pass	Jacksonville District 5-year O&M schedule[1]
Pas-A-Grill Pass	Based on frequency of past events as given in Jacksonville District dredging history database
Big Bend	Based on a 3-year cycle as provided by TBDMAC
Port Sutton Terminal Channel	Based on a 3-year cycle as provided by TBDMAC
Blind Pass	Dredging history in Inlet Management Plan indicates a 5-year interval, last dredging in 1990
Big Bend Berthing Areas	Based on a 3-year cycle as provided by TBDMAC
Intracoastal Waterway Berthing Areas	No information available
Manatee Harbor Berthing Areas	No information available
Manatee River Berthing Areas	Not expected to be dredged
Port Sutton Terminal Channel Berthing Areas	Based on a 3-year cycle as provided by TBDMAC
St. Petersburg Harbor Berthing Areas	No information available
Tampa Harbor Berthing Areas	No information available
John's Pass Berthing Areas	No information available
Pas-A-Grill Pass Berthing Areas	No information available
Hillsborough County	Information provided by TBDMAC
Manatee County	Information provided by TBDMAC
Pinellas County	No information available
St. Petersburg County	Information provided by TBDMAC
Miscellaneous	Information provided by TBDMAC
Notes: 1. This schedule is subject to funding and, therefore, change. 2. Five years is assumed to be the dredging interval unless available information dictates otherwise. 3. Ten years is assumed to be the maximum dredging interval, unless otherwise noted.	

The total amount of material to be removed during all maintenance events is about 33,300,000 cubic yards. This figure is not too far off from the 31,800,000 cubic yards calculated for removal during maintenance events over the next 25 years using the yearly removal amounts from Tables 1 and 2. Approximately 26,400,000 cubic yards of the total of 33,300,000 cubic yards is from Federal channels (79%); the remaining 6,900,000 cubic yards from non-Federal channels, berthing areas, and private locations (21%).

Table 6. Table 6 lists the probable methods of dredging for each major bay segment. The information contained in this table is historic in origin, that is, it is based on methods used in the past. Many factors contribute to the selection of one dredging method. Among these factors are the physical characteristics of the material to be dredged, the quantity of material to be removed, the dredging depth, the distance to the placement area, the physical environment of and between the dredging and placement areas, the contamination level of the sediments, the method of placement, the production required, and the types of dredges available. Probable methods of dredging are often dictated as a permit condition. For example, the permit issued by FDEP for maintenance dredging in Upper Hillsborough Bay restricts dredging activities to hydraulic (specific condition number 4).

Dredging equipment employs either mechanical or hydraulic means to remove sediment from a specific location. There are three principal types of dredges, as follows: hydraulic pipeline types (cutterhead, dustpan, plain suction, and sidecaster), hopper dredges, and mechanical types (clamshell and dipper). The sediment is then transported to a placement location. Transportation methods generally include pipelines, barges or scows, and hopper dredges. Pipeline transport is associated with hydraulic dredges. Barges and scows are associated with mechanical dredging. Hopper dredges transport dredged material in self-contained hoppers. Additional information on dredging is found in the U.S. Army Corps of Engineers' document entitled, "Dredging and Dredged Material Placement" (Engineer Manual [EM] 1110-2-5025). This document is available on the Internet at the following address: http://www.usace.army.mil/inet/usace-docs.

Sediment resuspension during dredging may impact biological resources. Resuspension of contaminated sediment during dredging may also be a concern. Studies have been conducted to address resuspension (McLellan et al., 1989; Cullinane et al., 1986). In general, hydraulic dredging uses large quantities of water to remove and transport sediment. Water may make up 80 or 90% of the slurry resulting from hydraulic dredging. This is more of a concern during placement than removal, particularly if the placement is in a confined upland area. On the other hand, the concern for resuspension during mechanical dredging may be greater during removal than placement as turbidity can be created when water rushes into the space created as material is removed by the bucket (clamshell) and as the bucket is lifted up through the water. Sediment

resuspension can be minimized at the excavation site or at the placement site. The following excavation site controls and operational techniques can be used to minimize turbidity: cutterhead rotation speed, depth of cut, swing speed, and clamshell bucket descent speed (McLellan et al., 1989; Cullinane et al. 1986). Among placement site controls are turbidity containment technologies such as cofferdams, dikes, sediment traps, and silt curtains. The U.S. Army Corps of Engineers has developed two computer models to address sediment resuspension; STFATE (Short Term FATE), a dredged material fate model required for open water placement consideration (for example, placement by split hull barge), and LTFATE (Long Term FATE), a dredged material fate model that addresses stability of dredged material after placement. The U.S. Army Corps of Engineers Technical Note DOER-E6, 'Estimating Dredging Sediment Resuspension Sources', is found with the supplemental information at the end of this report. The technical note addresses sediment resuspension sources and their estimation for input into a third model called SSFATE (Suspended Sediment FATE). This model computes suspended sediment plumes resulting from a dredging operation, for example, a clamshell dredge. Sediment resuspension is another topic covered in EM 1110-2-5025. Two pages discussing sediment resuspension have been extracted from the EM and are found in the supplemental information section at the end of this document. Sediment resuspension is addressed by the FDEP as a dredging permit condition requiring turbidity controls and monitoring so that a turbidity level of 29 NTUs (turbidity units) over background levels is not exceeded. Turbidity is further discussed below.

Table 7. The intention of Table 7 is to identify the physical and chemical qualities of the material to be removed. The chemical qualities are presented in the table as flagged chemicals of concern, those chemicals identified during testing as significant in light of the analyses performed, or as 'no chemicals of concern identified'. References to laboratory reports or websites giving information pertinent to the specific testing events are included in the table if they are available. Contact persons are listed if they have been identified.

The primary tool used by the Corps of Engineers for testing of material to be dredged is the testing manual entitled, 'Evaluation of Dredged Material Proposed for Ocean Disposal' (EPA 503/8-91/001 February 1991). The following three paragraphs are excerpted from this manual. The entire manual can be found on the Environmental Protection Agency's website at the following address: www.epa.gov/owow/oceans/gbook.

> This manual, commonly referred to as the "Green Book," is an update of *Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters* (EPA/USACE, 1977). The manual contains technical guidance for determining the suitability of dredged material for ocean disposal through chemical, physical, and biological evaluations. The technical guidance is intended for use by dredging applicants, laboratory scientists, and regulators in evaluating dredged-material compliance with the United States Ocean Dumping Regulations.

> Integral to the manual is a tiered-testing procedure for evaluating compliance with the limiting permissible concentration (LPC) as defined by the ocean-dumping regulations. The procedure comprises four levels (tiers) of increasing investigative intensity that generate information to assist in making ocean-disposal decisions. Tiers I and II utilize existing or easily acquired information and apply relatively inexpensive and rapid tests to predict environmental effects. Tiers III and IV contain biological evaluations that are more intensive and require field sampling, laboratory testing, and rigorous data analysis.
>
> This manual provides National technical guidance for use in making LPC compliance determinations for proposed discharges of dredged material; it does not provide comprehensive guidance on other factors that should be considered during the sediment-evaluation process. Decision-making, involving the evaluation of regulations and local policies, site conditions, and project-specific management actions to limit environmental impacts, is addressed in other Environmental Protection Agency (EPA)/United States Army Corps of Engineers (USACE) guidance manuals.

A water quality parameter of potential concern during dredging is turbidity. The Florida surface water quality criterion for turbidity is less than or equal to 29 nephelometric turbidity units above natural background conditions (Florida Administrative Code 62-302.530). This criterion holds for all classes of water. The classes follow:

CLASS I Potable Water Supplies
CLASS II Shellfish Propagation or Harvesting
CLASS III Recreation, Progagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
CLASS IV Agricultural Water Supplies
CLASS V Navigation, Utility and Industrial Use

"Natural background" means the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department of Environmental Protection. The establishment of a natural background for an altered waterbody may be based upon a similar unaltered waterbody or on historical pre-alteration data (62,302.400, F.A.C.).

Turbidity is defined by the American Public Health Association as an "expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through the sample". There are several units in which turbidity is measured, including jackson turbidity units, turbidity units, and nephelometric turbidity units (NTU). Turbidity standards have been made from many substances, including silica, Fuller's earth, diatomaceous earth, acid-washed stream bed sediment, and formazin. The recognized measurement at present is NTU and the standard is a formazin suspension. Equipment used to measure turbidity includes the turbidimeter, the spectrophotometer, and submersible-sensor instruments such a multiparameter instrument with a turbidity sensor. There are USEPA-approved specifications for turbidity instruments and

the U.S. Geological Survey's publication "Techniques of Water-Resources Investigations" Book 9 describes turbidity equipment and supplies. A complete listing of the books in the TWRI series is available on-line at the following address: http://oregon.usgs.gov/pubs_dir/twri-list.html.

An example of a specific FDEP permit condition, from a permit issued to the Corps, requiring turbidity monitoring follows. This is the type of turbidity monitoring typically performed for Corps dredging jobs.

> *Turbidity in Nephelometric Turbidity Units shall be measured twice daily (am and pm, at least 4 hours apart) during dredging according to the following plan. All measurements shall be made on site as soon as possible after the samples are collected.*
>
> *Dredging Site:*
>
> *Compliance—one (1) sample at each of two (2) depths (surface and mid-depth) at a point 150 meters downcurrent from the dredge within the densest portion of any visible turbid plume.*
>
> *Background—one (1) sample at a point at least 500 meters up-current of the area influenced by the dredging operation and away from any visible turbid plume.*
>
> *Disposal Site:*
>
> *Compliance—one (1) sample at each of two (2) depths (surface and mid-depth) at a point 150 meters downcurrent from the outfall of the disposal site within the densest portion of any visible turbid plume.*
>
> *Background—one (1) sample at a point at least 500 meters up-current of the area influenced by the outfall of the disposal site and away from any visible turbid plume.*
>
> *After Violations:*
>
> *If a turbidity violation is noted, sampling after corrective actions have been taken is required at the site of the violation (dredging or disposal). The samples shall be taken in the same manner as the routine monitoring and at the same locations at 2-hour intervals until the samples indicate no violation is present.*
>
> *If monitoring shows turbidity at any of the compliance stations exceeds that of the background station by more than 29 NTUs, all appropriate actions shall be taken to reduce turbidity to below this level. The actions taken shall include dredge shut down if necessary. Any such occurrence shall also be immediately reported to the Department of Environmental Protection.*

Table 8. Table 8 correlates dredging locations with their project sponsors. All Federal navigation projects have a non-Federal sponsor to participate in decision making and to assist in funding the project, if cost sharing is required.

The data presented in Tables 1-8 are meant to be revised in the event additional historical data becomes available and as more dredging events occur.

There is quite a bit of uncertainty in the data used to generate the shoaling estimates presented in Tables 1-8. Federal dredging records and data collections are improving with time and uncertainty will be lessened in the future as accuracy and thoroughness in recordkeeping advance. For this reason it is recommended that this plan be updated from time to time. Non-Federal dredging records (including non-Federal channels, berthing areas, and private areas) were scarcer and therefore the data presented in this plan may not be comprehensive. Undoubtedly more dredging of marinas takes place than that given in this plan. Better estimates of shoaling will be produced from better (more) non-Federal (channels, berthing areas, and marinas) data. The City of Tampa is developing a Residential Canal Dredging manual for the City of Tampa canals and lagoons on Davis Island and the Westshore area. Information contained in this manual may contribute to a better estimate of shoaling in private areas. A copy of a portion of the draft manual is included in the supplemental information section of this report. According to page 3 of the draft manual approximately 387,700 cubic yards of material require removal from the canals. The canals are identified in the tables following this text, however, the specific volume is not included in the calculations for shoaling since not enough information was available to permit computation of a shoaling rate or identification of a removal schedule.

Existing and potential placement options

Dredged material placement is categorized as open-water placement, confined (diked) placement, or placement for beneficial use. Open-water placement occurs in rivers, lakes, estuaries, or oceans. Some types of open-water placement are submerged discharge, lateral containment, thin-layer placement, and capping and contained aquatic placement. Confined placement occurs in diked areas located nearshore or upland. Beneficial use placement is intended to serve a productive use. Beneficial use placement can be open-water, confined, or unconfined placement. Examples of beneficial use placement are beach nourishment, habitat restoration/enhancement (wetland, upland, island, aquatic sites for use by waterfowl and other birds), aquaculture, parks and recreation, agriculture, forestry, and horticulture, strip mine reclamation, landfill cover, shoreline stabilization and erosion control (fills, artificial reefs, nearshore berms), construction and industrial use (port development, airports, urban, and residential), and material transfer (fill, dikes, levees, parking lots, roads). The U.S. Army Corps of Engineers' Engineer Manual entitled, "Beneficial Uses of Dredged Material" (EM 1110-2-5026) contains detailed information on each of these types of beneficial use. This document is available on the Internet at the following address: http://www.usace.army.mil/inet/usace-docs.

The proceeding discussion on beneficial use of dredged material is conceptual, however, the Corps has three programs under which it studies and constructs projects intended to benefit the environment. These three programs are the following:

1. Section 204 of the Water Resources Development Act of 1992, *as amended*

Section 204 gives the Secretary of the Army the authority to enter into cooperative projects with non-Federal sponsors to use dredged material from new or existing Federal projects to protect, restore, or create aquatic and ecologically related habitats, including wetlands. The environmental, economic, and social benefits, monetary and non-monetary, must justify the costs, and the project must not result in environmental degradation. The cost sharing (25% non-Federal, 75% Federal) would be applied to the incremental cost above the least cost method of dredged material disposal consistent with engineering and environmental criteria.

2. Section 206 of the Water Resources Development Act of 1996

Section 206 authorizes the Secretary of the Army to carry out aquatic ecosystem restoration projects that will improve the quality of the environment, are in the public interest, and are cost-effective. Individual projects are limited to $5 million in Federal cost. Non-Federal interests must contribute 35% of the cost of construction and 100% of the cost of operation, maintenance, replacement, and rehabilitation. The program has an annual program limit of $25 million. This program received initial funding of $6 million in fiscal year 1998.

3. Section 1135 of the Water Resources Development Act of 1986, as amended

The Corps of Engineers has the authority to make modifications to the structures and operations of water resources projects constructed by the Corps of Engineers to improve the quality of the environment. The primary goal of these projects is ecosystem restoration with an emphasis on projects benefiting fish and wildlife. To qualify under this program, projects must be justified—that is, the benefits resulting from constructing the project both monetary and non-monetary must justify the cost of the project. The project also must be consistent with the authorized purposes of the project being modified, environmentally acceptable, and complete within itself. Each separate project is limited to a total cost of not more that $5 million, including studies, plans and specifications, and construction.

Tables 9 through 11 list placement sites in the Tampa Bay area for dredged material and give some information on site owners, site operators, site capacities, and restrictions on material acceptable for placement at the sites. For many sites capacity estimates are unknown. Sites listed as potential fill sites are included in this report to indicate they have been given consideration as components of habitat restoration projects. Any sites mentioned in the plan as possible depositories for dredged material must be evaluated by the customary planning and permitting processes prior to construction. The intention of listing

possible fill sites for habitat restoration is to raise awareness of the existence of these sites.

U.S. Army Corps of Engineers policy (Engineer Regulation 1105-2-100) addresses placement of dredged material on beaches as follows:

> Construction and maintenance dredging of Federal navigation projects shall be accomplished in the least costly manner possible (Engineer Regulation 1130-2-307). When placement of dredged material (beach quality sand) on a beach is the least costly acceptable means for disposal, then such placement is considered integral to the project and cost shared accordingly. In cases were [sic] placement of dredged material on a beach is more costly than the least costly alternative, the corps may participate in the additional placement costs when (1) requested by the state; (2) the Secretary of the Army considers it in the public interest; and (3) the added cost of disposal is justified by hurricane and storm damage benefits (see Section IV). When all local cooperation requirements are met the Corps may cost share the additional costs 50 percent (Section 933, WRDA 1986, as amended). In cases where the additional costs for placement of the dredged material is not justified, the Corps may still perform the work if the State requests it, and the state or other sponsor contributes 100 percent of the added cost. If the State requests, the Corps may enter into an agreement with a political subdivision of the State to place the sand on its beaches, with the subdivision responsible for the additional costs. The Corps should consider and accommodate to the degree reasonable and practicable a state's or subdivision's schedule For providing its cost share. Each placement event should be supported by a separate decision document. Subsequent decision reports may be supplements to the original Section 933 decision document.

The U.S. Army Corps of Engineers has made a commitment to consider for placement on Egmont Key any beach quality dredged material removed from Federal projects in the Tampa Bay area if to do so is economical and environmentally sound. Cost sharing partners will be sought to assist in funding such an effort if necessary. Cost sharing may involve funding added costs over those for the least cost placement method. Documentation of the Jacksonville District's commitment to place beach quality material on Egmont Key is included at the end of this report. Historically, beach quality material has not been available from the Tampa Harbor project for placement on Egmont Key from locations that are cost-effective.

Beach quality material is removed from the St. Johns Pass and Pass-A-Grill Pass Federal navigation projects and placed on Pinellas County beaches as the least cost placement method. The policy cited above is not used in these cases since beach placement is the least cost placement method. The policy is, however, available for use if beach quality material is available and beach placement is not

the least cost method. This may be the case for some of the upper reaches of the Tampa Harbor project, for example, Cut C, and it is recommended that this and other possible cases be studied and beach placement implemented where possible.

Table 9. Table 9 lists existing placement sites. The sites that receive material from Federal projects are the ocean dredged material disposal site (ODMDS), the nearshore confined dredged material placement area known as 2-D, the nearshore confined dredged material placement area known as 3-D, an upland placement area owned by Port Manatee, and the Pinellas County beaches, which have in the past received beach quality material. Sites receiving material from non-Federal projects include Cargill's Alafia River Site 'C', and the Big Bend sites IMC/Agrico, TECO DA-1, and TECO DA-5.

The ODMDS is located approximately 21 miles west of Tampa, in the Gulf of Mexico (Figure 13). It was designated as an EPA-approved ocean placement site for the placement of suitable dredged material on Thursday, May 11, 1995. The final site designation is found at the end of this report. The final Environmental Impact Statement for the ODMDS was prepared by EPA and is dated September 1994. Designation of the ODMDS as EPA-approved provides an environmentally acceptable option for the ocean placement of dredged material. However, all placement activities are evaluated by the Corps on a case-by-case basis. Management of the site is a responsibility of the Corps and the EPA. The Corps issues permits to private applicants for ocean placement while the EPA assumes overall responsibility for site management. Before material can be placed in the ODMDS a permit must be issued for placement. Dredged material must be deemed suitable for placement in the site. The site is not restricted to Federal use only and private applicants may request a permit to place suitable material at the site. The limitations on the quantity of material that may be placed at the site are unknown.

Construction and maintenance disposal areas 2-D and 3-D (CMDA 2-D and CMDA 3-D) [Figure 14] were created as part of the deepening of the Federal Tampa Harbor project between 1978 and 1982. The construction of CMDA 2-D was to require approximately 5,500,000 cubic yards of dredged material and it was to hold approximately 16,000,000 cubic yards of material. The construction of CMDA 3-D was to require approximately 4,500,000 cubic yards of dredged material and it was to hold approximately 13,000,000 cubic yards of material. The capacity remaining for 2-D of 441,000 cubic yards is based on a 1998 survey and the knowledge that material dredged during two maintenance events since then will have gone into the placement area. The capacity remaining for 3-D of 3,614,000 cubic yards is based on a 1990 survey.

Four privately-owned upland placement areas are listed in Table 9 for placement of material from the Alafia River and Big Bend channels. These have no

remaining capacity. The areas adjacent to the Alafia River may be candidates for enlargement by raising the dikes.

One upland placement area is listed in Table 9 for placement of material from the Federal Manatee Harbor project. This area is owned by Port Manatee. Material is mined from the placement area as needed and when available. The present capacity of the placement area is unknown. A study is underway to examine the feasibility of raising the dikes on this placement area to increase capacity. No details on the expansion are available at this time.

The Pinellas County beaches are listed as an entry in Table 9. Beach quality material removed from Federal and non-Federal dredging is placed on these beaches when it is economically and environmentally acceptable to do so. No capacity figures are given for the beaches since placement depends on the amount of beach quality material available for dredging and needed on the beaches. Placement intervals depend similarly on dredging and beach requirements.

Table 10. Table 10 lists planned expansions to existing placement areas and proposed new placement areas. Expansions are planned for both CMDA 2-D and CMDA 3-D. Raising the dike heights on both islands will increase the capacity of each area by approximately 10,000,000 cubic yards. The capacity estimates will be refined as studies for both areas progress. The increased capacity figure for CMDA 2-D comes from the Tampa Port Authority's Dredged Material Management Plan whereas the figure for CMDA 3-D comes from the Corps' 1997 Big Bend Channel Feasibility Report. Both figures are based on raising the dike heights to +40 feet (present dike heights are about +20 feet). Information is not included on the expansion of the Port Manatee placement area as it is unavailable at this time.

Table 11. This table lists potential fill sites and includes habitat restoration and other beneficial use sites. This list is taken primarily from the July 25, 1997 'Prioritizing Habitat Restoration Sites in the Tampa Bay Region' Workshop Summary. Some of these sites are located on Figures 15a and 15b. The intention of listing possible fill sites for habitat restoration is to raise awareness of the existence of these sites, not to skirt or expedite any planning or permitting process. Any sites listed in this table as possible depositories for dredged material must be evaluated by the customary planning and permitting processes prior to construction. Most fill sites would receive material one time only to meet the environmental objectives established for the area. Several sites are currently being filled with dredged material and one site has a recurring need for material. This is the Lena Road Landfill in Manatee County. Two sites listed in the table that could repeatedly receive dredged material are Egmont Key and Ben T. Davis Beach. The need for material at Egmont Key is discussed in the Egmont Key Erosion Control Project Feasibility Study, a report prepared in 1997 by Coastal Planning & Engineering, Inc for the FDEP.

The quantity of fill required by these sites, the quality of the fill, and potential permitting or logistical problems need to be determined. For example, possible conflicts exist between filling for beneficial use and not filling for recreational fishing. As another example, the shell mining pits in central and upper Tampa Bay need to be located and surveyed (Taylor). The U.S. Army Corps of Engineers Technical Note DOER-C2 (May 1999) addresses the nature and types of physical, engineering, chemical, and biological characterization tests appropriate for determining the potential for beneficial uses of dredged material. A copy of the paper is found in the supplemental information section at the end of this document.

Several beneficial use placements are in the planning stages for U.S. Army Corps of Engineers projects. These are as follows: raising the bottom surface elevation of the deauthorized Federal Garrison Channel; filling Hooker's Point (construction fill); creating wetlands east of CMDA 2-D; creating additional bird nesting habitat just south of Bird Island; and filling mining pits near Cockroach Bay.

Several notes can be gleaned from these tables. These are as follows:

- There is an offshore placement site of unlimited capacity. To date this site has been cost effective for placement of material dredged from Federal channels in the lower end (closest to the Gulf) of Tampa Bay. This site is available to all users subject to permitting.
- The usual placement area for material from Federal channels in the upper reaches of Tampa Bay is either CMDA 2-D or CMDA 3-D, whichever is closer to the site of the dredging. These placement areas are nearing capacity and expansions of these areas (by raising the dikes) are planned.
- Historically there have been some upland placement areas available for material dredged from Federal channels. There are several upland placement areas available for material dredged from non-Federal channels, berthing areas, and other private areas. These upland areas have been or are being filled to capacity. The 1998 Tampa Port Authority Dredged Material Management Plan states, "As a result of past growth management legislation, and very intense development pressures for this area, the entire area under study is subject to development constraints…acquisition of a 1000 acre site for a disposal area and the necessary buffers could cost in excess of $25 million. Such a [sic] expenditure is simply not feasible for the Authority, even if the land were to be available and could be redesignated under the land use plan."
- A substantial amount of beach quality dredged material is unavailable.
- Areas exist where dredged material might be placed to benefit the environment or for environmental restoration. However, little information exists on the quantities and qualities of fill required for these sites.

Capacity shortfall

Table 12 determines the anticipated shortfall in placement area capacity for the next 25 years. Both maintenance dredging and new work dredging are included in Table 12. Shortfall volumes are calculated considering the cost of using particular placement sites in relation to the point of the dredged material production. The ODMDS is typically the placement site for material dredged from Federal channels near the lower end of Tampa Bay. Approximately 11,800,000 cubic yards of material will be placed there over the next 25 years. While the capacity of the ODMDS is unknown, there is no anticipated shortfall volume for the ODMDS.

CMDAs 2-D and 3-D are typically the placement sites for material dredged from Federal channels in the upper part of Tampa Bay. Approximately 5,700,000 cubic yards of material will be dredged from areas in Tampa Bay that typically use CMDA 2-D for placement. The estimated capacity of CMDA 2-D is 800,000 cubic yards, therefore, the anticipated shortfall volume is about 4,900,000 cubic yards. Raising the dikes on CMDA 2-D may bring the capacity to 10,800,000 cubic yards with no shortfall. Approximately 14,000,000 cubic yards of material will be dredged from areas in Tampa Bay that typically use CMDA 3-D for placement. The estimated capacity of CMDA 3-D is 3,600,000 cubic yards, therefore, the anticipated shortfall volume is about 10,400,000 cubic yards. Raising the dikes on CMDA 3-D may bring the shortfall to 400,000 cubic yards.

Another way to increase the capacity of a confined disposal area such as CMDA 2-D or 3-D is to mine the material in the area for use at another location. For example, beach quality material could be extracted and placed on a beach. Material suitable for construction fill could be removed and used elsewhere. Confined disposal area mining should be investigated for both CMDA 2-D and 3-D.

Approximately 1,800,000 cubic yards of material will be dredged from the Tampa Bay area that is suitable for beach placement. There appears to be no shortage of placement areas for beach quality material in the Tampa Bay area, only a shortage of material to place there. The Pinellas County beaches are the usual placement areas for this material. However, Egmont Key is another possible location for placement of beach quality material. The Egmont Key feasibility study presents several placement plans, requiring between 3,000,000 and 30,000,000 cubic yards of beach quality material.

About 4,400,000 cubic yards of material will be dredged from the Tampa Bay area and used for beneficial uses.

Approximately 5,800,000 cubic yards of material will be dredged from other areas in Tampa Bay (non-Federal channels, berthing areas, marinas) over the next 25 years. Historically a range of locations has been used for placement of this

material. Some of the material could go into the ODMDS, some into CMDA 2-D or 3-D, some for beneficial uses, but most likely the majority will go into upland placement areas. As indicated in the tables, the 1993 U.S. Army Corps of Engineers Disposal Area Study, and the Tampa Port Authority dredged material management plan, securing upland placement areas is difficult due to land use issues and cost.

Capacity shortfall is not singular to Tampa Bay. The document entitled, 'Long-Term Management Strategy (LTMS) For the Placement of Dredged Material in the San Francisco Bay Region' identifies a physical capacity limitation at one of its in-Bay sites as a driving factor in the generation of the strategy. The Port of New York/New Jersey has a considerable shortfall in terms of currently available and permitted placement sites. The Dredged Material Management Plan (DMMP) for the Port evaluated a number of possible containment and treatment options for the Federal and non-Federal maintenance and deepening material projected to be dredged there over the next forty years. In addition, it also looked at measures to reduce future sediment contamination as well as other innovative management techniques. While a shortfall in fully permitted and operating sites exists, the DMMP lays out a process for implementing additional sites as needed throughout the next forty years. Given the strong desire to use dredged material beneficially in the region, only environmentally preferable options are recommended for implementation with reliable containment options developed as contingency. The fact sheet found in the supplemental information section at the end of this report provides additional information on the DMMP.

The following paragraphs relating to nationwide placement area capacity are taken from the Corps' Institute For Water Resources webpage on the National Harbors Study. The webpage can be viewed at: http://www.wrsc.usace.army.mil/iwr/Services/PDCPNHarbors.htm.

> In May of 1996, the Policy and Special Studies Division of the Corps' Institute For Water Resources wrapped up its National study on the *Need for Changes in Dredged Material Disposal Policy*. The study included a nationwide survey of potential disposal problems and needs at Corps projects. Corps Districts reported that 123 deep draft projects will require new disposal options within 20 years, all of which will experience problems in siting and developing disposal areas. In a majority of cases, the problems are considered to be readily resolvable before traffic is adversely affected. However, 53 projects present moderate to substantial disposal problems, the economic consequences of which could be severe if not resolved in a timely manner. Most of these 53 projects will require more costly disposal options to avoid adverse environmental effects. Rough estimates indicate that the potential incremental costs for meeting all environmental requirements could range up to $3.4 billion over the next 20 years, about $1.5 billion of which would be a non-Federal responsibility under pre-WRDA '96 policy; and all of which would have been a non-Federal responsibility under present budgetary constraints.
>
> The cost sharing changes constitute a compromise solution to a longstanding problem. For one-third of existing projects, LERRs [lands, easements, relocations and rights-of-way] would have been a Federal responsibility. WRDA

> '96 provides that CDF [confined disposal facility] construction costs will be cost shared if non-Federal interests agree to provide all LERRs.

In summary, without increasing the capacities of CMDA 2-D and CMDA 3-D, a significant shortfall in dredged material placement capacity is anticipated for the Tampa Bay area. The shortfall is expected to be greatest for material dredged between Cut G and Cut C (Hillsborough Bay), and then for material dredged north of Cut C (Hillsborough Bay). Even with increased capacity in both CMDA 2-D and CMDA 3-D a shortfall is anticipated. This shortfall is expected for material dredged between Cut G and Cut C (Hillsborough Bay). Dredging in these areas is both Federal and non-Federal. A shortfall is cause for concern as it may imply inability to maintain sufficient water depths for commerce.

Economics is an important factor in dredging and the placement area plays a role in the economics. Federal projects must use the least cost, environmentally acceptable method of dredging and placement. As the placement area capacity decreases, the cost of dredging is expected to increase. One reason for this is that material may have to be transported further to an acceptable placement area. With this increase in dredging cost may come an increased interest in innovative technologies, such as the beneficial uses listed later in this plan. An analysis of Federal dredging events between 1980 and 2000 yields the following results. The analysis was conducted by reach according to the typically practiced placement; dredging events from the entrance channel to Cut G usually place material in the ODMDS, dredging events between Cut G and Cut C (Hillsborough Bay) usually place material in CMDA-3D, and dredging events north of Cut C (Hillsborough Bay) usually place material in CMDA-2D.

Reach	Average Cost	High Cost	Low Cost	Trend
A	$2.08	$3.14	$1.51	Up
B	$3.57	$6.94	$1.25	Up
C	$4.11	$7.40	$2.06	Down

The data on which this cursory analysis is based are found in the Supplemental Information section. Note that the ODMDS was unavailable for placement between approximately 1985 and 1995.

CONCEPTUAL PLAN

The goal of the conceptual plan is the creation of a list of placement alternatives whose capacity total is the same as, or greater than, the projected volume of material to be dredged in the next 25 years.

A list of projects intended for conceptual approval from permitting agencies is contained in Tables 9, 10, and 11 accompanying this plan. The projects on the list should, as a goal, meet U.S. Army Corps of Engineers requirements for dredged material placement.

The following ideas/actions make up the conceptual plan. Volumes to be accommodated by the conceptual plan placement options are listed in Table C.

1. **Beach placement.** Beach quality material should be placed on Tampa Bay area beaches whenever possible. To assist in assuring that beach quality material is placed on beaches whenever possible it is recommended that further analysis be conducted to identify sources of beach quality material, placement beaches, non-Federal sponsors (to bear the cost of beach placement, if necessary) and funding sources.

2. **Beneficial use.** Beneficial use should be made of dredged material whenever possible. To ensure beneficial use options are fully explored it is recommended that two areas be analyzed in further detail: in general, beneficial use options need to be better defined and, specifically, more detailed information needs to be gathered for the habitat restoration projects already listed.

3. **Traditional placement.** Maximum use should be made of existing placement options, namely, the ODMDS, CMDA 2-D and CMDA 3-D. These sites should be aggressively managed, for example, CMDA 2-D and CMDA 3-D could be further dewatered by wicking or other techniques. The dikes on CMDA 2-D and CMDA 3-D can be raised. CMDA 2-D and CMDA 3-D can be mined for usable material. The ODMDS can be monitored to gain as much information as is needed to fully use this site, for example, field studies can be conducted and modeling performed to describe and predict the dispersive nature of the site and to attempt to define the limitations of the site.

4. **Upland placement/placement of material dredged by non-Federal and private interests.** While the beach, ODMDS, CMDA 2-D and CMDA 3-D sites are traditionally used for placement of material from Federal projects, placement areas are needed for material from non-Federal and private projects. In order to provide these placement areas, a list of upland sites should be developed, as well as a list of beneficial use/habitat restoration sites/projects, that may be available specifically for non-Federal/private use. Sharing of all sites by all parties should be addressed.

TABLE C
Conceptual Plan Placement Sites and Volumes

Site	Table Reference	Volume
Beach	12	1,800,000
Beneficial Use	11	25,600,000
ODMDS	12	11,800,000
CMDA 2-D (dikes raised)	12	10,800,000
CMDA 3-D (dikes raised)	12	13,600,000
	Total	63,600,000

CONCLUSION

This report presents the results of three tasks, as follows: 1) develop dredged material volumes and describe dredged material quality, 2) identify existing and potential placement options, and 3) calculate the placement area capacity shortfall.

The total volume of dredged material expected for removal in the period 2000-2025 as a result of maintenance dredging or new work dredging in the Tampa Bay area is 42,000,000 cubic yards. The ODMDS offers a placement site for an unlimited amount of material at a reasonable cost for the lower region of Tampa Bay. CMDAs 2-D and 3-D are the standard placement alternative for material dredged from the upper region of Tampa Bay. These confined placement areas will reach capacity and must be enlarged or mined if they are to remain standard placement alternatives. Some material will be placed in upland placement areas as well as beaches. Some material will be put to beneficial use although this alternative requires additional study if it is to be applied widely. The total placement area capacity shortfall for the period 2000-2025 is 15,300,000 cubic yards. The shortfall for placement area CMDA 2-D is 4,900,000 cubic yards and the shortfall for placement area CMDA 3-D is 10,400,000 cubic yards. No shortfall is anticipated for the ODMDS, beach placement, or beneficial use placement. The shortfall for other placement areas (upland) is unknown.

The conceptual plan to meet the needs of placement capacity for the next 25 years involves four components, as follows: beach placement, beneficial use, traditional placement, and upland placement/placement of material dredged by non-Federal and private interests. Additional work is necessary in order to put the conceptual plan into action. A list of the additional work follows:

1. identify sources of beach quality material, placement beaches, non-Federal sponsors (to bear the cost of beach placement, if necessary) and funding sources
2. better define beneficial use options and gather more detailed information for the habitat restoration projects already listed
3. aggressively manage CMDA 2-D and CMDA 3-D, raise the dikes on CMDA 2-D, mine CMDA 2-D and CMDA 3-D for usable material, monitor the ODMDS to gain as much information as is needed to fully use this site
4. develop a list of upland sites, as well as a list of beneficial use/habitat restoration sites/projects, specifically for non-Federal/private use and address sharing of all sites by all parties.

The conceptual plan provides capacity for 63,600,000 cubic yards of dredged material. This more than meets the requirement of 42,000,000 cubic yards.

Suggestions for Further Study

In addition to periodic revision and expansion of this DMMP and implementation of the conceptual plan, the following are recommended for further action:

1. Additional study of dredged material volumes and placement, as this report is based on readily accessible data only. For example, the quantity of dredged material removed by private interests is most likely under-represented in the data and with a more extensive effort a more accurate volume might be determined. Federal dredging records could be examined in light of technical, surveying, reporting, and regulatory variations throughout the history of their collection. Such an examination might produce a refined estimate of the material dredged from Federal channels and therefore a better starting point for projecting future dredging volumes. In addition, an attempt could be made to better project a growth or decline in the amount of material dredged from the bay area. Dredged material volumes could be presented as ranges for all the categories considered.

2. Collection of dredged material characteristic data. Available data on dredged material characteristics were scarce. Characteristics of interest include physical characteristics, chemical characteristics, contamination and toxicity, and fate and movement.

3. Development/refinement of a computer-based circulation/salinity/sediment movement model for Tampa Bay. Either develop a new or revise an existing circulation model for Tampa Bay that would give an overall picture of circulation patterns in the bay and that would allow refinement of the model to give a detailed picture of circulation in specific locations. This effort would provide ready access to information on water flow patterns for planning and permitting purposes.

4. An analysis of dredging and disposal methods commonly used in the Tampa Bay area, with the goal of better understanding the physical processes that occur during removal and placement of sediments and a focus on impacts. This analysis could include a detailed investigation of environmental effects, including sediment resuspension. A purpose of this analysis would be to provide information on environmental acceptability, technical feasibility, and economic feasibility, factors upon which management decisions can be made.

5. An investigation of beneficial uses of dredged material (including habitat development and commercial applications). Beneficial use options need to be further analyzed since they offer great promise as a “placement” alternative and since they provide an opportunity for improvement or restoration of environmentally significant habitats. There are many ways to beneficially use dredged material. Some of these ways are the following:

1) Habitat development

a) Wetlands (salt marsh, freshwater tidal, riverine, lacustrine/depressional)
b) Thin-layer dredged material placement
c) Confined disposal facility/recreational site
d) Seagrass restoration using dredged material substrates (including offshore transverse bars to protect and restore seagrasses)

2) Commercial applications

a) Aquaculture
b) Manufactured soil
c) Superfund site cover
d) Landfill cover
e) Mining site cover
f) Brownfield redevelopment
g) Topsoil
h) Parks
i) Bagged soil
j) Golf courses
k) Landscaping
l) Ornamental figurines/statues
m) Construction fill
n) Patio garden construction
o) Building blocks

Not only should all of these uses be considered in a further examination of beneficial use of dredged material, but also the mining of placement areas CMDA 2-D and 3-D should be considered since without mining these placement areas have finite capacity, even if their dikes are raised.

6. An inventory of the environment, with a focus on the aquatic environments of the Gulf of Mexico and Tampa Bay and the upland environments in the area of interest.

7. An examination of the economic activity (commercial and recreational) that creates the demand for dredging, including the financing of dredging and placement.

8. A summary of the regulations that guide dredging and placement, including permitting. This effort could include descriptions of the roles of Federal, State and local agencies and how the agencies coordinate. A focus of the summary might be to highlight the funding policies that could support the conceptual plan.

9. A discussion on implementing regional sediment management, with a focus on identifying roadblocks that might stand in the way of implementation. Regional sediment management considerations might include an upland, or a confined, placement area (with re-use of material) that is sponsored and used by

a number of interests. This would be in contrast to present management, where the Federal placement areas are primarily the ODMDS and the two CMDAs and the other placement areas are upland. A tool that might encourage regional sediment management is a geographic information systems product that makes available, via the internet, all of the data presented in this DMMS. The computer software product DMSMART developed under the Dredging Operations and Environmental Research (DOER) program and applied within New York District as DAN-NY might serve as a springboard from which to create such a tool. A copy of the Corps of Engineers' Technical Note DOER-N2, entitled "Dredged Material Spatial Management, Analysis, and Record Tool (DMSMART)" is found in the Technical Notes section of the Supplemental Information at the end of this report. This paper describes the dredging and placement site management challenges that are well-suited to the capabilities of a GIS-based software system, and describes DAN-NY and DMSMART.